

WHAT IS CLAIMED IS:

1. A level measurement device for making level measurements of a material in a vessel, said level measurement system comprising:

a housing;

a transducer for emitting energy pulses and receiving energy pulses reflected by the material contained in the vessel;

a circuit having a transmit component and a receive component, said transmit component being coupled to said transducer and said transducer being responsive to a transmit signal for emitting an energy pulse, said receive component being coupled to said transducer and said receive component generating a receive signal in response to a reflected energy pulse being received by said transducer;

said circuit including a port for coupling to a controller, and said port including an input for receiving transmit control signals, and output for outputting the receive signal to said controller;

said transducer comprising a planar antenna formed on the surface of a printed circuit board, said planar antenna having an input port coupled to the transmit component, and an output port coupled to the receive component in the circuit.

2. The level measurement device as claimed in claim 1, wherein said planar antenna emits energy pulses in the microwave range.

3. The level measurement device as claimed in claim 2, further including another printed circuit board, and said circuit being situated on said other printed circuit board, and said other printed circuit board being arranged in a spaced relationship to said printed circuit board for said planar antenna, and both of said printed circuit board being located inside said enclosure.

4. The level measurement device as claimed in claim 1, wherein said planar antenna is responsive to transmit and receive energy pulses in the range of 5.8 GigaHertz.

5. The level measurement device as claimed in claim 4, wherein said circuit includes a converter stage, said converter stage having an input port coupled to the output of said receive component and an output port coupled to the input of said transmit component, and said converter stage including a circuit for converting the output from receive component to a lower frequency in the ultrasonic range.

6. The level measurement device as claimed in claim 5, wherein said converter stage includes another circuit component for converting a low frequency input into a higher frequency output for said transmit component, said higher frequency output being in the microwave range.

7. A level measurement system for measuring the levels of materials contained in one or more vessels, said level measurement system comprising:

- a plurality of microwave-based devices;

- a plurality of ultrasonic-based devices;

- a controller, said controller having a plurality of ports for coupling each of said microwave-based devices and said ultrasonic-based devices, said controller providing control signals to each of said microwave-based and said ultrasonic-based devices to transmit energy pulses and said controller receiving reflected energy pulses from each of said microwave-based and said ultrasonic-based devices to generate a receive echo profile for each of said devices and determine a level measurement reading;

- wherein said microwave-based devices are interchangeable with said ultrasonic-based devices for said controller.

8. The level measurement system as claimed in claim 7, wherein said microwave-based device comprises: an enclosure; a circuit having a transmit component and a receive component, said transmit component being coupled to said transducer and said transducer being responsive to a transmit signal for emitting an energy pulse, said receive component being coupled to said transducer and said receive component generating a receive signal in response to a reflected energy pulse being received by said transducer; said circuit including a port for coupling to a controller, and said port including an input for receiving transmit control signals, and output for outputting the receive signal to said controller; said transducer comprising a planar antenna formed on the surface of a printed circuit board, said planar antenna having an input port coupled to the transmit component, and an output port coupled to the receive component in the circuit.

9. The level measurement device as claimed in claim 8, further including another printed circuit board, and said circuit being situated on said other printed circuit board, and said other printed circuit board being arranged in a spaced relationship to said printed circuit board for said planar antenna, and both of said printed circuit board being located inside said enclosure.

10. The level measurement system as claimed in claim 8, wherein said planar antenna is responsive to transmit and receive energy pulses in the range of 5.8 GigaHertz.

11. The level measurement system as claimed in claim 10, wherein said circuit includes a converter stage, said converter stage having an input port coupled to the output of said receive component and an output port coupled to the input of said transmit component, and said converter stage including a circuit for converting the output from receive component to a lower frequency in the ultrasonic range.

12. The level measurement system as claimed in claim 11, wherein said converter stage includes another circuit component for converting a low frequency input into a higher frequency output for said transmit component, said higher frequency output being in the microwave range.

13. A level measurement device for making level measurements of a material in a vessel, said level measurement system comprising:

- a housing;

- a transducer for emitting energy pulses and receiving energy pulses reflected by the material contained in the vessel;

- a circuit having a transmit component and a receive component, said transmit component being coupled to said transducer and said transducer being responsive to a transmit signal for emitting an energy pulse, said receive component being coupled to said transducer and said receive component generating a receive signal in response to a reflected energy pulse being received by said transducer;

- said circuit including a port for coupling to a controller, and said port including an input for receiving transmit control signals, and output for outputting the receive signal to said controller;

- said transducer comprising a planar antenna formed on the surface of a first printed circuit board, said planar antenna having an input port coupled to the transmit component, and an output port coupled to the receive component in the circuit;

- a second printed circuit board, and said circuit being situated on said other printed circuit board, and said other printed circuit board being arranged in a spaced relationship to said printed circuit board for said planar antenna, and both of said printed circuit board being located inside said enclosure; and

- a converter stage, said converter stage having an input port coupled to the output of said receive component and an output port coupled to the input of said transmit component, and said converter stage including a circuit for

conv rting the output from receive component to a lower frequency in the ultrasonic range.

14. A level measurement instrument for making level measurements of a material in a vessel, said level measurement instrument comprising:

a housing;

a transducer for emitting energy pulses and receiving energy pulses reflected by the material contained in the vessel;

a transmitter and a receiver, said transmitter being coupled to said transducer and said transducer being responsive to a transmit signal for emitting an energy pulse, said receiver being coupled to said transducer and said receiver generating a receive signal in response to a reflected energy pulse being received by said transducer;

a port for coupling to a controller, and said port including an input for receiving transmit control signals, and output for outputting the receive signal to said controller;

said transducer comprising a planar antenna formed on the surface of a printed circuit board, said planar antenna having an input port coupled to said transmitter, and an output port coupled to said receiver.

15. The level measurement device as claimed in claim 14, wherein said planar antenna emits energy pulses in the microwave range.

16. The level measurement device as claimed in claim 14, further including another printed circuit board, and said transmitter and said receiver being situated on said other printed circuit board, and said other printed circuit board being arranged in a spaced relationship to said printed circuit board for said planar antenna, and both of said printed circuit board being located inside said enclosure.

17. The level measurement device as claimed in claim 13, wherein said planar antenna is responsive to transmit and receive energy pulses in the range of 5.8 GigaHertz.

18. The level measurement device as claimed in claim 17, further comprising a converter stage, said converter stage having an input coupled to said receiver and an output port coupled to said transmitter, and said converter stage including a circuit for converting the output from receiver to a lower frequency in the ultrasonic range.

19. A level measurement device for making level measurements of a material in a vessel, said level measurement system comprising:

- a housing;

- a transducer for emitting energy pulses and receiving energy pulses reflected by the material contained in the vessel;

- a transceiver circuit having a transmit port and a receive port, said transmit port being coupled to said transducer and said transducer being responsive to a transmit signal for emitting an energy pulse, said receive port being coupled to said transducer and said receive port receiving a receive signal in response to a reflected energy pulse being received by said transducer;

- said transceiver circuit including a port for coupling to a controller, and said port including an input for receiving transmit control signals, and output for outputting the receive signal to said controller;

- said transducer comprising a planar antenna formed on the surface of a printed circuit board, said planar antenna having an input port coupled to said transmit port, and an output port coupled to said receive port in said transceiver circuit.

20. The level measurement device as claimed in claim 19, wherein said planar antenna emits energy pulses in the microwave range.

21. The level measurement device as claimed in claim 20, further including another printed circuit board, and said circuit being situated on said other printed circuit board, and said other printed circuit board being arranged in a spaced relationship to said printed circuit board for said planar antenna, and both of said printed circuit board being located inside said enclosure.